SOME MORPHOLOGICAL AND ECOLOGICAL OBSERVATIONS ON *CHARA CANESCENS* (CHAROPHYTE)

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ABSTRACT - Two forms of *Chara canescens* are reported: a) fertile form without cortex; b) form with stalked oogonia. Cultivation of *C. canescens* in water with different salt content gave optimal growth in the oligohaline area.

RÉSUMÉ - Deux formes de *C. canescens* ont été observées: a) une forme fertile sans cortex; b) une forme avec oogones pedicellés. La culture de *C. canescens* dans des eaux de salinité variable, met en évidence une croissance optimale dans le domaine oligohalin.

KEY WORDS : Charophyta, *Chara canescens*, morphology, ecology, culture.

INTRODUCTION

Chara canescens Lois. has been found scattered along the coast of the Oslofjord in Southern Norway. Its present distribution is probably restricted to the Hvaler islands, and here again in two brackishwater polls: viz Viker-kilen and Skipstadkilen (Langangen, 1972). In 1992 I visited Skipstadkilen twice; once in early spring and once in late summer. On both occasions I collected specimens for further observations, both morphological and ecological.

Chara canescens is the only dioecious, haplosticous species with complete cortication known (Corillion, 1975 p. 72). The new species *Chara shanxiensis* Ling - described from specimens from China (Ling, 1985) differ from *Chara canescens* by having swollen endcells - is here presumed to be a form of the latter. Similar forms are described in Migula (1897) (f. *conferta* and f. *condensata*), and was reported in Langangen (1970, fig. 22) from specimens growing on the muddy bottom in Skipstadkilen. *Chara canescentiformis* Hollerbach, described from specimens in Russia (Hollerbach, 1983), is presumed to be *Chara canescens* f. *thermalis* A.Br. as it fits the description of this form. Migula (1897) describes *Chara canescens* as a species with many varieties and forms. He devides the forms in two groups according to the length of the spine-cells: 1) formae *longispinae* and 2) formae *brevispinae*. The forms described in Migula are accepted by Corillion (1957).

OBSERVED MORPHOLOGICAL VARIETIES

MATERIAL AND METHODS

On 22.8.1992 I collected specimens of *Chara canescens* in Skipstadkilen which I cultivated in a culture-vessel (1,5 dm^3) with water from the locality (salinity 13‰).

RESULTS

One month later (16.9.92) many new shoots had grown out from the stem-nodia of the old specimens. Among these new plants I found fertile specimens without cortex. This phenomenon has not earlier been reported from this species.

Description of the ecorticated form of *Chara canescens*

The height is 10 mm (Fig. 1). Stem-diameter 200 µm. Internodes 1.5 mm to 2.75 mm long. The specimen described had a total of 5 internodes. The lower internode had descending cortical cells, with few single spine-cells varied from 150 µm to papillous. Four upper internodes were without cortex. The number of branchlets in each whorl was 8-9. Each branchlet had (1) 4-5 segments and one end-cell. The branchlets were longer to much longer than the internodes. The two uppermost whorls had 3-5 celled branchlets and without bract-cells. All branchlets were without cortex. Bract-cells well developed around the nodes of branchlets at lowest whorl, were up to

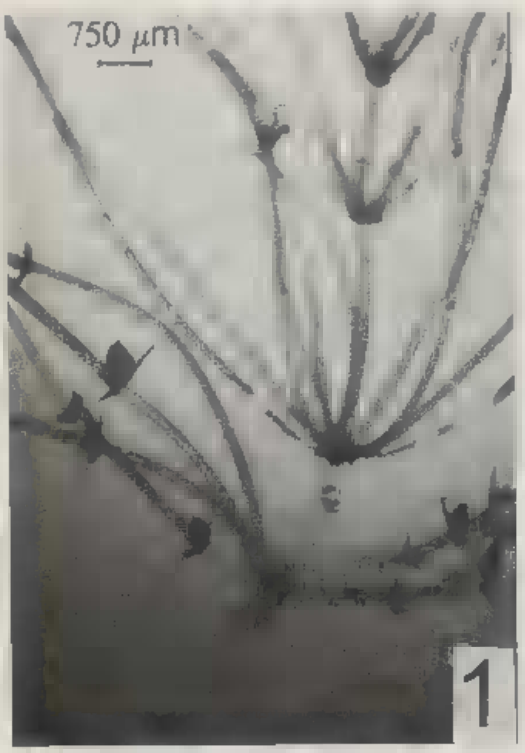

Figure 1. *Chara canescens*. The described ecorticated type with oogonia.
Figure 2. *Chara canescens*. Stalked oogonium.

250 µm long. Bracteoles were up to 750 µm long. Stipulodes in two tiers, the upper normal, the lower rudimentary. Specimen fertile, dioecious, only with oogonia as common in Northern Europe (Corillion 1957, carte 38). The specimen described has five oogonia. The length of one oogonium was 500 µm, 300 µm wide. The number of convolutions on oogonia are 7. Coronula 75 µm high, and 125 µm wide at base. One oospore was 250 µm long.

Form with stalked oogonia

In October 1992 (9.10.92) I found in the same culture normal types with stalked oogonia (Fig. 2). The length of one oogonium on these plants was 700 µm and the stalkcell was 600 µm.

OBSERVED RESPONS TO DIFFERENT WATER TYPES

MATERIAL AND METHODS

Plants grown from oospores were collected on 28.5.1992. The height of these plants were 3-5 cm exclusive of the protonematal internode, which was up to 2,5 cm long (Fig. 3). Above the protonematal whorl were 3-4 internodes. Branchlets here are without cortex, with 4-5 segments. The lower branchlet-nodes with bract-cells. The stem-cortex was regular haplostichous. Spine-cells 2-3, dense together. Small unripe oogonia.

The content of salt in the water of the locality can vary much during the season. On 28.5.92 I measured 5.09 g l^{-1} and on 22.8.92 12.8 g l^{-1}.

In the growth experiment I used brackishwater from 28.5.92 and *Chara*-lake water with an average content of iones (Langangen, 1974). The four types of water I used was:

1. brackishwater from the locality
2. 50% brackishwater (1) and 50% *Chara*-lake water (4)
3. ca. 10% brackishwater (1) and 90% *Chara*-lake water (4)
4. *Chara*-lake water (freshwater)

The growth experiment took 5 weeks (22.5-27.6.92). The culture-vessel with algae was placed outdoors facing north. The air temperature at this time was high (for June Tx= 24.1°C (max. middle) and Tm= 17.8°C (day/night middle)).

RESULTS

1. Brackishwater

The salt content was 5,09 g l^{-1}. The plants grew up to 8-10 cm in height. They were healthy. Ripe oospores were found after two weeks at the lower whorls. At the end of the period the plants were rich fruiting with ripe oospores and orange/red oogonia both on the old and on side-shoots.

2. Brackish/freshwater 50/50

Salt content 1,22 g l^{-1}, 650 mg Cl l^{-1}. The plants grew up to 16-18 cm in height. Already after two weeks some plants were up to 15 cm heigh, and with very many ripe oospores on the lower whorls. At the end of the period the plants were extremely rich fruiting, with ripe oospores and with orange/red oogonia on top and on side-shoots.

Figure 3. *Chara canescens.* Young plant with protonemal internode.

3. Brackish/freshwater 10/90

Salt content 0.34 g l^{-1}, 225 mg Cl l^{-1}

The plants grew up to 9-10 cm in height. Ripe oospores were found on lower whorls after two weeks, and then together with masses of white oogonia. At the end of the period some ripe oospores were found, but the growth of *Chara canescens* had stagnated. Filamentous algae of the genus *Oedogonium* were growing very well at the end of the period, but did not seemed to be the reason for the stagnated growth of *Chara canescens.*

4. *Chara*-lake water

Salt content 0.13 g l^{-1}, 3 mg Cl l^{-1}

These plants were transfered from brackishwater to freshwater on 3.6.92. The height was then between 5-7cm. After tree weeks the height was between 9-10 cm, but growth had clearly stagnated. Only a few new shoots had grown out of the plants, and no ripe oospores or orange/red oogonia where found.

DISCUSSION

Optimal growth of *C. canescens* was obtained in water with a oligohaline salt content (chloride content 650 mg l^{-1}). The species did not survive for long in freshwater.

Chara canescens is reported as a brackishwater species by most authors (e.g. Olsen, 1944), with tolerance limits for salinity 4 - 20 ‰ Reports of *C. canescens* from

the oligohaline area (0.18-1.8 ‰) are not found often in published studies. Stroede (1933) states through he gives no evidence of this, that "Der Minimalwert dürfte nicht weit unter 1000 mg im liter liegen" (Cl). The first well documented occurrence of *C. canescens* in oligohaline water is given by Winter *et al.* (1987). They found the species in an inland saline lake, Kuhgrabensee in Bremen (Germany) - in association with different Spermatophyta and charophytes *C. globularis* Thuill., *C. delicatula* Agardh, *C. vulgaris* L. and *Nitellopsis obtusa* (Desvaux) J. Groves. The salinity of the lake water was 1,5 ‰, and the chloride content ca. 700 mg l^{-1}.

Specimens of *C. canescens* which I have seen from Kuhgrabensee differ from specimens in my material by being markedly incrusted and by being compact in appearence (short distances between the whorls, f. *compacta* Migula). Later Winter & Kirst (1991) have done interesting work on the turgor regulation system of *C. canescens* and other charophytes. They found that *C. canescens* from the Kuhgrabensee had ■ turgor regulation system intermediate between the saline/brackishwater species *Lamprothamnium papulosum* (Wallroth) J. Groves and freshwater species of *Nitella* without ■ regulation system. This is interesting, as *C. canescens* in the warm springs of Svalbard live in water with a salinity of around 0,8 ‰. Maybe the populations here represent an ancient type of the species (Langangen, 1979). This will be discussed in ■ forthcoming article on the Svalbard population of the *C. canescens* (Langangen in. prep.)

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